New Hampshire Volunteer Lake Assessment Program

2003 Interim Report for Cobbetts Pond Windham

NHDES
Water Division
Watershed Management Bureau
29 Hazen Drive
Concord, NH 03301

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **COBBETTS POND, WINDHAM,** the program coordinators have made the following observations and recommendations:

We would like to thank your group for sampling your lake/pond once this summer. However, we would like to encourage your monitoring group to sample additional times each summer. Typically we recommend that monitoring groups sample three times per summer (once in June, July, and August). We understand that the number of sampling events you decide to conduct per summer will depend upon volunteer availability, your monitoring group's water monitoring goals and funding availability. However, with a limited amount of data it is difficult to determine accurate and representative water quality trends. Since weather patterns and activity in the watershed can change throughout the summer, from year to year, and even from hour to hour during a rain event, it is a good idea to sample the lake/pond at least once per month over the course of the season. Furthermore, with the presence of milfoil and the generally large size of the lake, it would be beneficial to include additional sampling events. (Please note that the lake was treated with the herbicide Diquat on May 21, 2004, to control the growth of milfoil.) If you are having difficulty finding volunteers to help sample or pick-up or drop-off equipment at one of the labs, please give the VLAP Coordinator a call and we will try to help you work out an arrangement.

As part of the state's lake survey program, DES biologists performed a comprehensive lake survey on **COBBETTS POND** this summer. Publicly-owned recreational lakes/ponds in the state are surveyed approximately every ten to fifteen years. In addition to the tests normally carried out by VLAP, biologists tested for certain indicator metals and nitrogen, created a map of the lake/pond bottom contours (referred to as a bathymetric map), and mapped the abundance and distribution of the aquatic plants along the shoreline. DES biologists will also sample the lake/pond once during the Winter of 2003-2004. Some data from this lake survey have been included in this report and has been added to the historical database for your lake/pond. If you would like a complete copy of the raw data from the lake survey, please contact the DES Limnology Center at (603) 271-3414 or (603) 271- 2658. A final report should be available in 2005 and a copy will be available at any state library.

FIGURE INTERPRETATION

- **Figure 1 and Table 1:** The graphs in Figure 1 (Appendix A) show the historical and current year chlorophyll-a concentration in the water column. Table 1 (Appendix B) lists the maximum, minimum, and mean concentration for each sampling season that the lake/pond has been monitored through the program.

  Chlorophyll-a, a pigment naturally found in plants, is an indicator of the algal abundance. Because algae are usually microscopic plants that contain chlorophyll-a, and are naturally found in lake ecosystems, the chlorophyll-a concentration measured in the water gives an estimation of the algal concentration or lake productivity. **The mean (average) summer chlorophyll-a concentration for New Hampshire's lakes and ponds is 7.02 mg/m^3.**

  STATION 1:

  The current year data (the top graph) show that the chlorophyll-a concentration in August was 5.43 mg/m^3, which is ***less than*** the state mean.

  Overall, visual inspection of the historical data trend line (the bottom graph) shows ***an increasing*** in-lake chlorophyll-a trend, meaning that the concentration has ***worsened*** since monitoring began.

  STATION 2:

  The current year data (the top graph) show that the chlorophyll-a concentration in August was 4.13 mg/m^3, which is ***less than*** the state mean.

  Overall, visual inspection of the historical data trend line (the bottom graph) shows ***a variable, but overall slightly increasing*** in-lake chlorophyll-a trend, meaning that the concentration has ***fluctuated, but overall slightly worsened*** since monitoring began.

  In the 2004 annual report, we will again be able to conduct a statistical analysis of the historic data to objectively determine if there has been a significant change in the annual mean chlorophyll-a concentration since monitoring began.

  While algae are naturally present in all lakes/ponds, an excessive or increasing amount of any type is not welcomed. In freshwater lakes/ponds, phosphorus is the nutrient that algae depend upon for growth. Algal concentrations may increase with an increase in nonpoint sources of phosphorus loading from the watershed, or in-lake sources of phosphorus loading (such as phosphorus releases from the sediments). Therefore, it is extremely important for volunteer monitors to continually educate residents about how activities within the watershed can affect phosphorus loading and lake/pond quality.

- **Figure 2 and Table 3:** The graphs in Figure 2 (Appendix A) show historical and current year data for lake/pond transparency. Table 3 (Appendix B) lists the maximum, minimum and mean transparency data for each sampling season that the lake/pond has been monitored through the program.

  Volunteer monitors use the Secchi-disk, a 20 cm disk with alternating black and white quadrants, to measure water clarity (how far a person can see into the water). Transparency, a measure of water clarity, can be affected by the amount of algae and sediment from erosion, as well as the natural colors of the water. **The mean (average) summer transparency for New Hampshire's lakes and ponds is 3.7 meters.**

  STATION 1:

  The current year data (the top graph) show that the in-lake transparency in August was 2.6 meters, which is ***less than*** the state mean.

  Overall, visual inspection of the historical data trend line (the bottom graph) shows ***a decreasing*** trend for in-lake transparency, meaning that the transparency has ***worsened*** since monitoring began.

  STATION 2:

  The current year data (the top graph) show that the in-lake transparency in August was 2.7 meters, which is ***less than*** the state mean.

  Overall, visual inspection of the historical data trend line (the bottom graph) shows ***a decreasing*** trend for in-lake transparency, meaning that the transparency has ***worsened*** since monitoring began.

  Again, as discussed previously, in the 2004 annual report, we will again be able to conduct a statistical analysis of the historic data to objectively determine if there has been a significant change in the annual mean transparency since monitoring began.

Typically, high intensity rainfall causes erosion of sediments into lakes/ponds and streams, thus decreasing clarity. Efforts should continually be made to stabilize stream banks, lake/pond shorelines, disturbed soils within the watershed, and especially dirt roads located immediately adjacent to the edge of tributaries and the lake/pond. Guides to Best Management Practices designed to reduce, and possibly even eliminate, nonpoint source pollutants, such as sediment loading, are available from DES upon request.

- **Figure 3 and Table 8:** The graphs in Figure 3 (Appendix A) show the amounts of phosphorus in the epilimnion (the upper layer) and the hypolimnion (the lower layer); the inset graphs show current year data. Table 8 (Appendix B) lists the annual maximum, minimum, and median concentration for each deep spot layer and each tributary since the lake/pond has joined the program.

Phosphorus is the limiting nutrient for plant and algae growth in New Hampshire's freshwater lakes and ponds. Too much phosphorus in a lake/pond can lead to increases in plant and algal growth over time. **The median summer total phosphorus concentration in the epilimnion (upper layer) of New Hampshire's lakes and ponds is 11 ug/L. The median summer phosphorus concentration in the hypolimnion (lower layer) is 14 ug/L.**

STATION 1:

The current year data for the epilimnion (the top inset graph) show that the phosphorus concentration in August was 11 ug/L, which is ***equal to*** the state median.

The current year data for the hypolimnion (the bottom inset graph) shows that the phosphorus concentration in August was 42 ug/L, which is ***much greater than*** the state median.

Overall, visual inspection of the historical data trend line for the epilimnion show an ***overall relatively stable*** phosphorus trend, which means that the concentration has ***remained approximately the same*** in the epilimnion since monitoring began.

Overall, visual inspection of the historical data trend line for the hypolimnion shows ***an increasing*** phosphorus trend, which means that the concentration has ***worsened*** in the hypolimnion since monitoring began.

STATION 2:

The current year data for the epilimnion (the top inset graph) show that the phosphorus concentration in August was 9 ug/L, which is ***slightly less than*** the state median.

The current year data for the hypolimnion (the bottom inset graph) show that the phosphorus concentration in August was 66 ug/L, which is ***much greater than*** the state median.

Overall, visual inspection of the historical data trend line for the epilimnion shows a ***relatively stable*** phosphorus trend, which means that the concentration has ***remained approximately the same*** in the epilimnion since monitoring began.

Overall, visual inspection of the historical data trend line for the hypolimnion shows ***an increasing*** phosphorus trend, which means that the concentration has ***worsened*** in the hypolimnion since monitoring began.

One of the most important approaches to reducing phosphorus loading to a waterbody is to continually educate watershed residents about its sources and how excessive amounts can adversely impact the ecology and value of lakes and ponds. Phosphorus sources within a lake or pond's watershed typically include septic systems, animal waste, lawn fertilizer, road and construction erosion, and natural wetlands.

TABLE INTERPRETATION

- **Table 2: Phytoplankton**
  Table 2 (Appendix B) lists the current and historic phytoplankton species observed in the lake/pond.

  The dominant phytoplankton species observed this year at **Station 1 and Station 2** were ***Tabellaria*** **(diatom)** ***and Aphanizomenon*** **(cyanobacteria).**

  Phytoplankton populations undergo a natural succession during the growing season (Please refer to the "Biological Monitoring Parameters" section of this report for a more detailed explanation regarding seasonal plankton succession). Diatoms and golden-brown algae are typical in New Hampshire's less productive lakes and ponds.

- **Table 2: Cyanobacteria (Blue-green algae)**
  One of the most dominant species observed in the plankton sample at **Station 1 and Station 2** this season was the cyanobacterium ***Aphanizomenon***. ***This species, if present in large amounts, can be toxic to livestock, wildlife, pets, and humans.***

  Cyanobacteria can reach nuisance levels when excessive nutrients and favorable environmental conditions occur. During September of 2003, a few lakes and ponds in the southern portion of the state experienced cyanobacteria blooms. This was likely due to nutrient loading to these waterbodies. As mentioned previously, many weeks during the Spring and Summer of 2003 were rainy, which likely resulted in a large amount of nutrient loading to surface waters.

  The presence of cyanobacteria serves as a reminder of the lake's/pond's delicate balance. Watershed residents should continue to act proactively to reduce nutrient loading into the lake/pond by eliminating fertilizer use on lawns, keeping the lake/pond shoreline natural, re-vegetating cleared areas within the watershed, and properly maintaining septic systems and roads.

  In addition, residents should also observe the lake/pond in September and October during the time of fall turnover (lake mixing) to document any algal blooms that may occur. Cyanobacteria (blue-green algae) have the ability to regulate their depth in the water column by producing or releasing gas from vesicles. However, occasionally lake mixing can affect their buoyancy and cause them to rise to the surface and bloom. Wind and currents tend to "pile" cyanobacteria into scums that accumulate in one section of the lake/pond. If a fall bloom occurs, please contact the VLAP Coordinator.

- **Table 4: pH**
  Table 4 (Appendix B) presents the in-lake and tributary current year and historical pH data.

  pH is measured on a logarithmic scale of 0 (acidic) to 14 (basic). pH is important to the survival and reproduction of fish and other aquatic life. A pH below 5.5 severely limits the growth and reproduction of fish. A pH between 6.5 and 7.0 is ideal for fish. The mean pH value for the epilimnion (upper layer) in New Hampshire's lakes and ponds is **6.5**, which indicates that the surface waters in state are slightly acidic. For a more detailed explanation regarding pH, please refer to the "Chemical Monitoring Parameters" section of this report.

The mean pH at the **STATION 1** deep spot this season ranged from **6.65** in the hypolimnion to **7.36** in the epilimnion, which means that the water in the hypolimnion is ***slightly acidic***, most likely due to decomposition**.** During this process, organic matter is broken down and acids can be released into the water column. This may be why the pH is more acidic in the hypolimnion than in the epilimnion.

The mean pH at the **STATION 2** deep spot this season ranged from **6.66** in the hypolimnion to **7.42** in the epilimnion, which means that the water in the hypolimnion is ***slightly acidic***. Again, this is most likely due to the decomposition process.

Due to the presence of granite bedrock in the state and the deposition of acid rain, there is not much that can be done to effectively increase lake/pond pH.

- **Table 5: Acid Neutralizing Capacity**
  Table 5 (Appendix B) presents the current year and historic epilimnetic ANC for each year the lake/pond has been monitored through VLAP.

  Buffering capacity or ANC describes the ability of a solution to resist changes in pH by neutralizing the acidic input to the lake. The mean ANC value for New Hampshire's lakes and ponds is **6.7 mg/L**, which indicates that many lakes and ponds in the state are "highly sensitive" to acidic inputs. For a more detailed explanation, please refer to the "Chemical Monitoring Parameters" section of this report.

  The Acid Neutralizing Capacity (ANC) of the epilimnion at both **Station 1 and Station 2** continues to remain ***much greater than*** the state mean of **6.7 mg/L**. Specifically, the ANC ranged **between 22 and 25 mg/L as $CaCO_3$**, which means that lake/pond is classified by DES as being ***not sensitive*** to acidic inputs (such as acid precipitation).

- **Table 6: Conductivity**
  Table 6 (Appendix B) presents the current and historic conductivity values for tributaries and in-lake data. Conductivity is the numerical expression of the ability of water to carry an electric current. The mean conductivity value for New Hampshire's lakes and ponds is **62.1 uMhos/cm**. For a more detailed explanation, please refer to the "Chemical Monitoring Parameters" section of this report.
  The conductivity continues to ***increase*** in both the in-lake and tributary sites. In addition, the in-lake conductivity is ***much greater than*** the state mean. Typically, sources of increased conductivity are

due to human activity. These activities include septic systems that fail and leak leachate into the groundwater (and eventually into the tributaries and the lake/pond), agricultural runoff, and road runoff (which contains road salt during the spring snow melt). New development in the watershed can alter runoff patterns and expose new soil and bedrock areas, which could contribute to increasing conductivity. In addition, natural sources, such as iron deposits in bedrock, can influence conductivity.

We recommend that your monitoring group conduct stream surveys and storm event sampling along the inlet(s) with elevated conductivity so that we can determine what may be causing the increases.

For a detailed explanation on how to conduct rain event and stream surveys, please refer to the 2002 VLAP Annual Report "Special Topic Article", or contact the VLAP Coordinator.

- **Table 8: Total Phosphorus**
  Table 8 (Appendix B) presents the current year and historic total phosphorus data for in-lake and tributary stations. Phosphorus is the nutrient that limits the algae's ability to grow and reproduce. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

- **Table 9 and Table 10: Dissolved Oxygen and Temperature Data**
  Table 9 (Appendix B) shows the dissolved oxygen/temperature profile(s) for the 2003 sampling season. Table 10 (Appendix B) shows the historical and current year dissolved oxygen concentration in the hypolimnion (lower layer). The presence of dissolved oxygen is vital to fish and amphibians in the water column and also to bottom-dwelling organisms. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

  The dissolved oxygen concentration was ***low in the hypolimnion*** at **Station 1 and Station 2**. As stratified lakes/ponds age, oxygen becomes ***depleted*** in the hypolimnion (the lower layer) by the process of decomposition. Specifically, the loss of oxygen in the hypolimnion results primarily from the process of biological breakdown of organic matter (i.e.; biological organisms use oxygen to break down organic matter), both in the water column and particularly at the bottom of the lake/pond where the water meets the sediment.

  In addition, during this season, and many past sampling seasons the lake/pond has had a lower dissolved oxygen concentration and a higher total phosphorus concentration in the **hypolimnion** (the lower layer) than in the epilimnion (the upper layer). These data suggest that the process of ***internal total phosphorus loading*** (commonly referred to as ***internal loading***) is occurring in the lake/pond. When oxygen levels are depleted to less than 1 mg/L in the hypolimnion, the phosphorus that is normally bound up with metals in the sediment may be re-released into the water column. Depleted oxygen concentration in the hypolimnion of thermally stratified lakes/ponds typically occurs as the summer progresses.

Again, this may explain why the phosphorus concentration in the hypolimnion is ***greater*** than the phosphorus concentration in epilimnion. Since an internal source of phosphorus in the lake/pond may be present, it is even more important that watershed residents act proactively to minimize external phosphorus loading from the watershed.

- **Table 11: Turbidity**

Table 11 (Appendix B) lists the current year and historic data for in-lake and tributary turbidity. Turbidity in the water is caused by suspended matter, such as clay, silt, and algae. Water clarity is strongly influenced by turbidity. Please refer to the “Other Monitoring Parameters” section of this report for a more detailed explanation.

The turbidity of the hypolimnion (lower layer) samples of both stations was elevated on the August sampling event. This suggests that the lake/pond bottom may have been disturbed by the anchor or by the Kemmerer Bottle while sampling. When the lake/pond bottom is disturbed, sediment, which typically contains attached phosphorus, is released into the water column. When collecting the hypolimnion sample, please check to make sure that there is no sediment in the Kemmerer Bottle before filling the sample bottles.

The turbidity in **Main Inlet** sample was also slightly elevated on the August sampling event, which suggests that the stream bottom may have been disturbed while sampling or that erosion is occurring in this portion of the watershed.

When the stream bottom is disturbed, sediment, which typically contains attached phosphorus, is released into the water column. When collecting samples in the inlets, please be sure to sample where there the stream is flowing and where the stream is deep enough to collect a “clean” sample.

If you suspect that erosion is occurring in this portion of the watershed, we recommend that your monitoring group conduct stream surveys and storm event sampling along this inlet. This additional sampling may allow us to determine what is causing the

elevated levels of turbidity.
For a detailed explanation on how to conduct rain event and stream surveys, please refer to the 2002 VLAP Annual Report "Special Topic Article", or contact the VLAP Coordinator.

- **Table 12: Bacteria (*E.coli*)**
  Table 12 lists the current year data for bacteria *(E.coli*) testing. *E. coli* is a normal bacterium found in the large intestine of humans and other warm-blooded animals. *E.coli* is used as an indicator organism because it is easily cultured and its presence in the water, in defined amounts, indicates that sewage **MAY** be present. If sewage is present in the water, potentially harmful disease-causing organisms may also be present. Please consult the "Other Monitoring Parameters" section of the report for the current state standards for *E. coli* in surface waters. If residents are concerned about sources of bacteria such as failing septic systems, animal waste, or waterfowl waste, it is best to conduct *E. coli* testing when the water table is high, when beach use is heavy, or after rain events.

  The *E.coli* concentration was **low** at the site tested this season. We hope this trend continues!

DATA QUALITY ASSURANCE AND CONTROL

Annual Assessment Audit:

During the annual visit to your lake/pond, the biologist conducted a "Sampling Procedures Assessment Audit" for your monitoring group. Specifically, the biologist observed the performance of your monitoring group while sampling and filled out an assessment audit sheet to document the ability of the volunteer monitors to follow the proper field sampling procedures (as outlined in the VLAP Monitor's Field Manual). This assessment is used to identify any aspects of sample collection in which volunteer monitors are not following the proper procedures, and also provides an opportunity for the biologist to retrain the volunteer monitors as necessary. This will ultimately ensure that the samples that the volunteer monitors collect are truly representative of actual lake and tributary conditions.

Overall, your monitoring group performed ***very well*** while collecting samples on the annual biologist visit this season! Specifically, the members of your monitoring group followed the majority of the proper field sampling procedures. The biologist did identify a few aspects regarding sample collection that the volunteer monitors could improve upon. They are as follows:

- **Finding the deep spot:** Please remember to locate the deep spot using three reference points from the shoreline. This method is known as ***triangulation***. In addition, depth finders and Global Positioning System (GPS) technology may be used to further pinpoint the location of the deep spot. In addition, please remember to check the depth of the deep spot by ***sounding*** to ensure that you have actually located the deepest spot. To sound the bottom, simply fill the Kemmerer bottle with lake water from the surface and then lower the bottle into the lake until you feel it touch the bottom. When you have reached the bottom, check the depth on the calibrated chain. You may need to move to another location and repeat this procedure a few times until the deepest spot is located. When you have found the deep spot, please remember to write the depth of the field data sheet. **Sounding may disturb the sediment, so please allow the bottom to settle out before collecting the deepest sample.**

- **Anchoring at deep spot:** Please remember to use an anchor with sufficient weight and sufficient amount of rope to prevent the boat from drifting while sampling at the deep spot. It is difficult for the biologist to collect an accurate and representative dissolved oxygen/temperature profile when the boat is drifting. In addition, it is difficult to view the secchi disk and collect samples from the proper depths when the boat is drifting. Depending on the depth of the lake/pond and the wind conditions, it may be necessary to use two anchors!

- **Hypolimnion (lower layer) sample collection:** Always remember to allow the lake/pond bottom to settle after you sound the bottom before collecting the hypolimnion (lower layer) sample. In addition, please be careful not to hit the lake/pond bottom and make sure that there is no sediment in the Kemmerer bottle before filling the sample bottles. When the lake/pond bottom is disturbed, sediment, which typically contains attached phosphorus, is released into the water column.

NOTES

STATION 1

- **Monitor's Note (8/27/03):** A lot of drifting occurred while sampling

- **Biologist's Note (8/27/03):** The phosphorous level at the hypolimnion was found to be elevated.

STATION 2

- **Monitor's Note (8/27/03):** A lot of drifting occurred while sampling

- **Biologist's Note (8/27/03):** The phosphorous level at the hypolimnion was found to be elevated.

USEFUL RESOURCES

Best Management Practices to Control Nonpoint Source Pollution: A Guide for Citizens and Town Officials, *NHDES-WD 97-8*, NHDES Booklet, (603) 271-3503.

Cyanobacteria in New Hampshire Waters Potential Dangers of Blue-Green Algae Blooms, NHDES Fact Sheet, (603) 271-3505, or www.des.state.nh.us/factsheets/wmb/wmb-10.htm.

Erosion Control for Construction in the Protected Shoreland Buffer Zone, WD-SP-1, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/sp/sp-1.htm

Lake Protection Tips: Some Do's and Don'ts for Maintaining Healthy Lakes, *WD-BB-9*, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/bb/bb-9.htm.

Management of Canada Geese in Suburban Areas: A Guide to the Basics, Draft Report, NJ Department of Environmental Protection Division of Watershed Management, March 2001, www.state.nj.us/dep/watershedmgt/DOCS/BMP_DOCS/Goosedraft.pdf.

Proper Lawn Care In the Protected Shoreland, The Comprehensive Shoreland Protection Act, WD-SP-2, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/sp/sp-2.htm.

Road Salt and Water Quality, WD-WMB-4, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/wmb/wmb-4.htm.

Sand Dumping - Beach Construction, *WD-BB-15*, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/bb/bb-15.htm.

Swimmers Itch, *WD-BB-2*, NHDES Fact Sheet, (603) 271-3503 or *www.des.state.nh.us/factsheets/bb/bb-2.htm.*

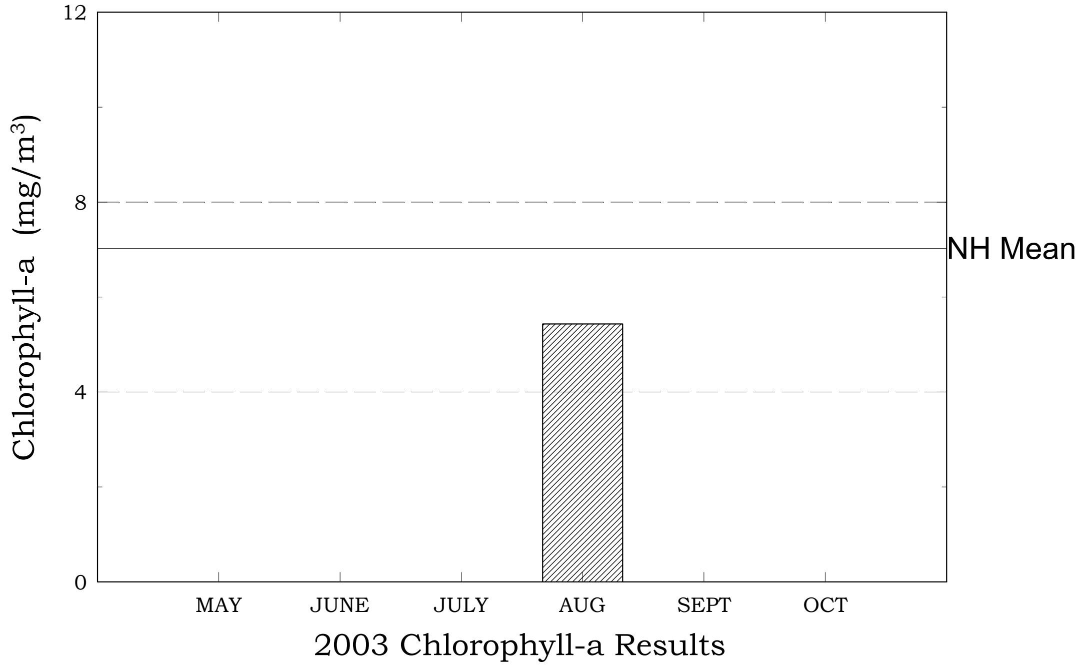
Weed Watchers: An Association to Halt the Spread of Exotic Aquatic Plants, WD-BB-4, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/bb/bb-4.htm.

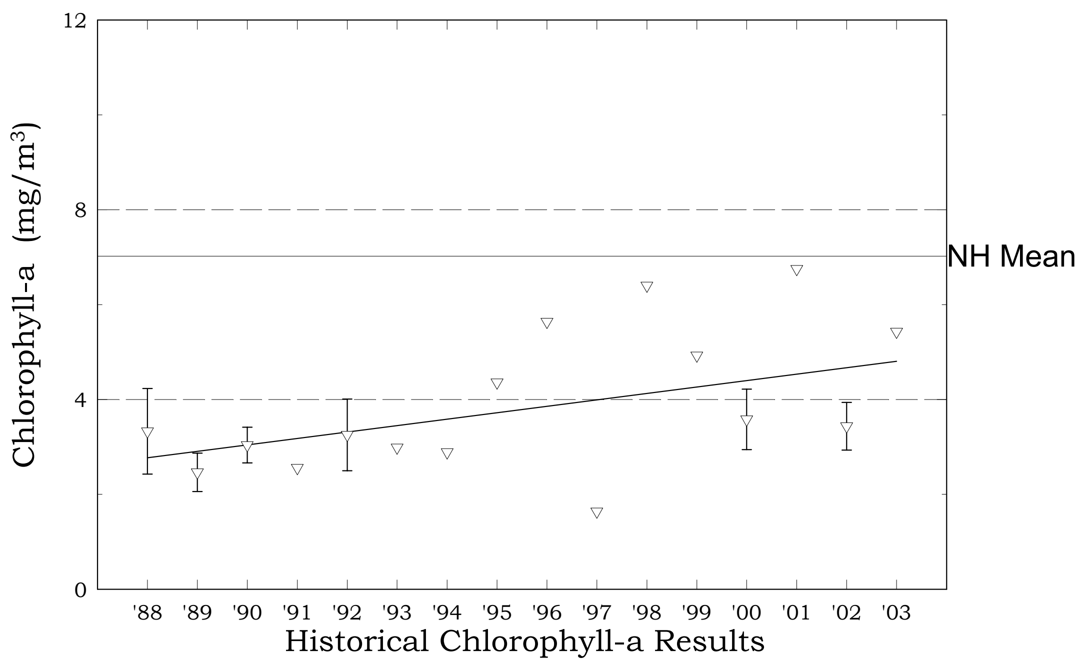
APPENDIX A

GRAPHS

Cobbetts Pond, Stn 1, Windham

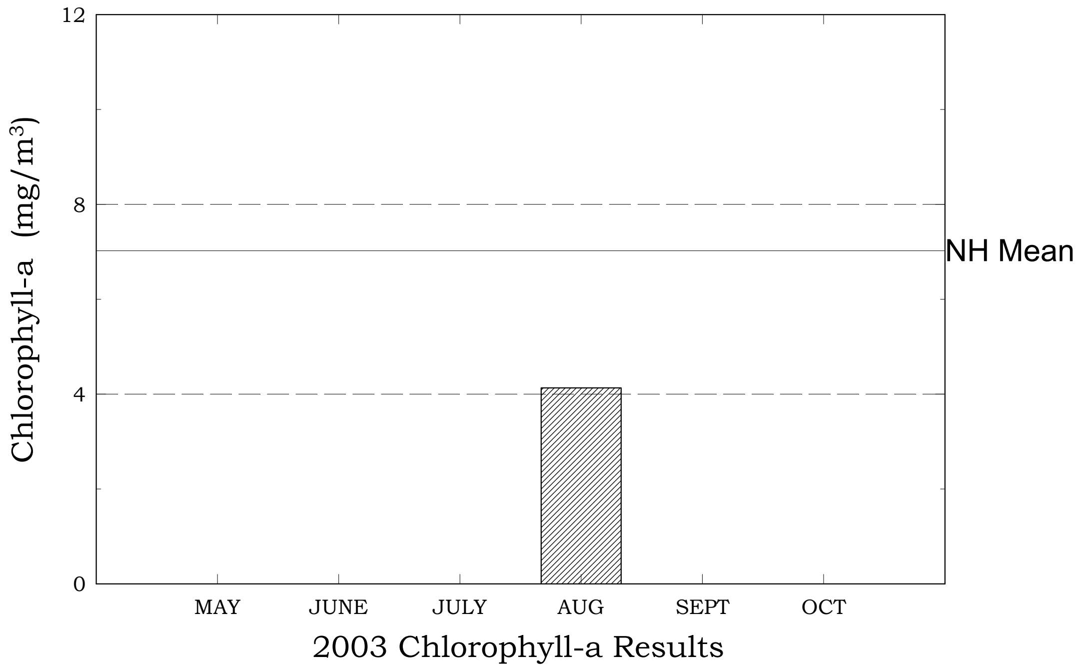
Figure 1. Monthly and Historical Chlorophyll-a Results

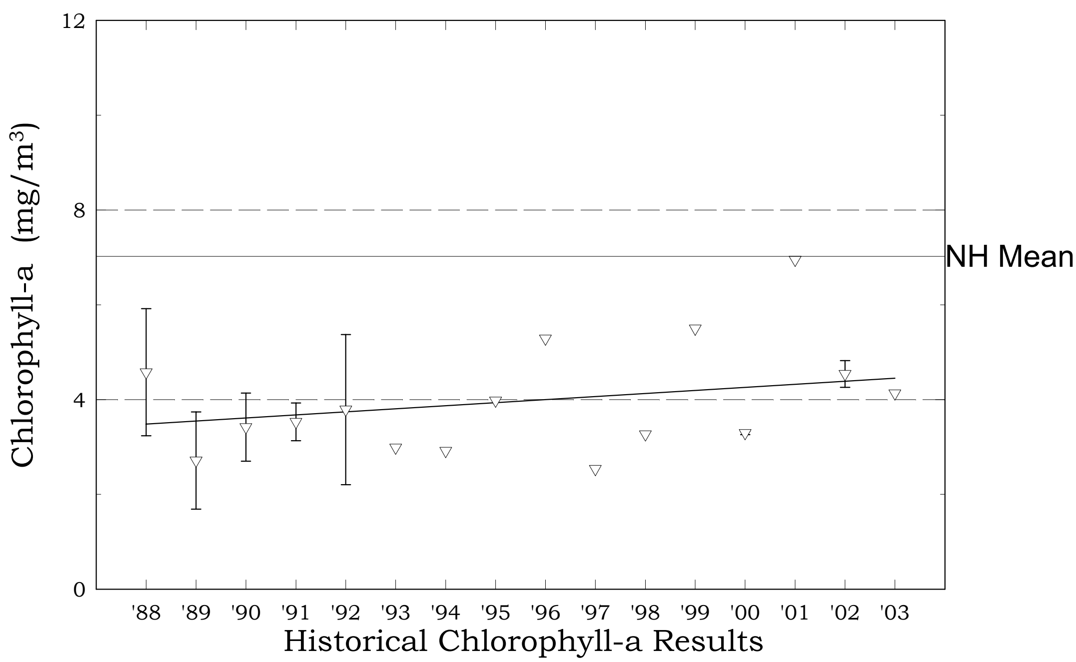




Cobbetts Pond, Stn 2, Windham

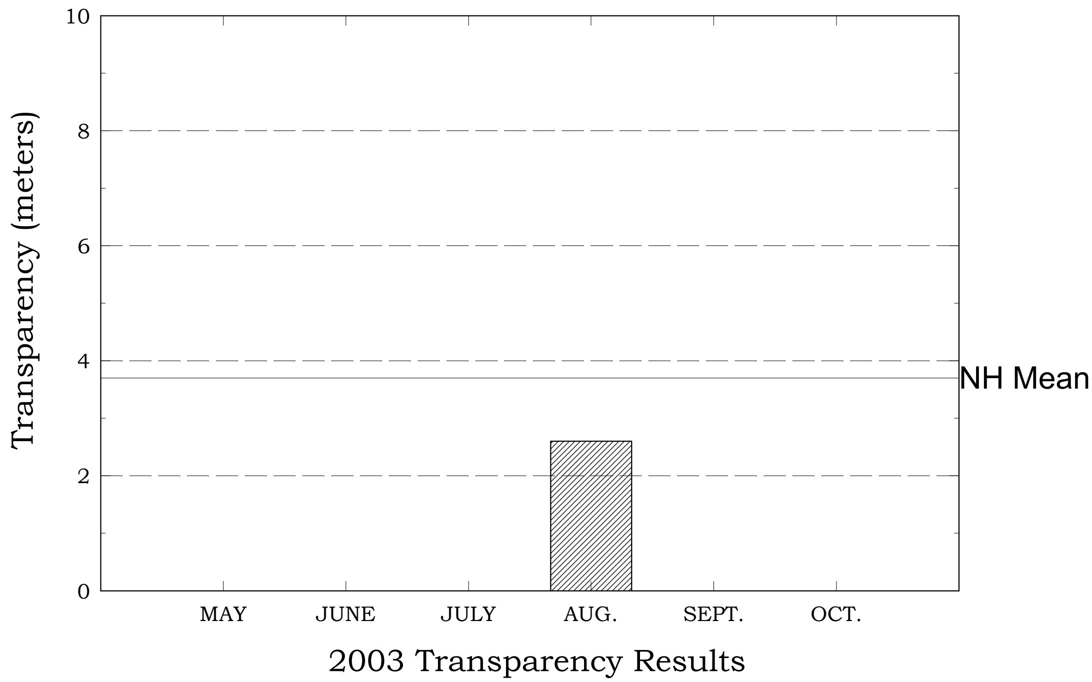
Figure 1. Monthly and Historical Chlorophyll-a Results

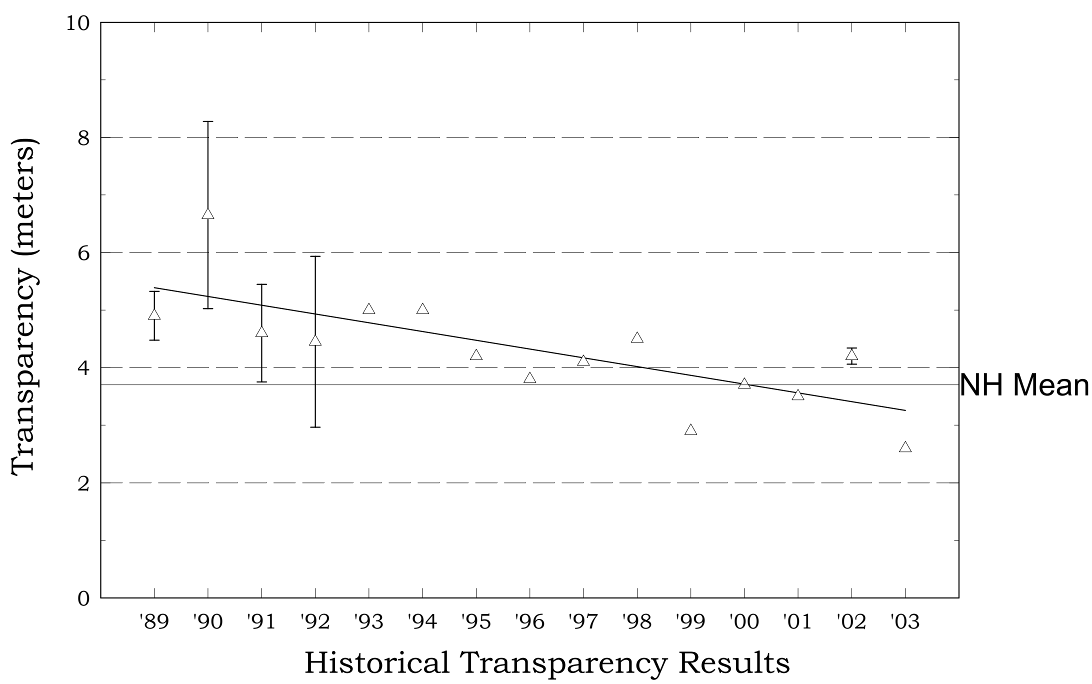




Cobbetts Pond, Stn 1, Windham

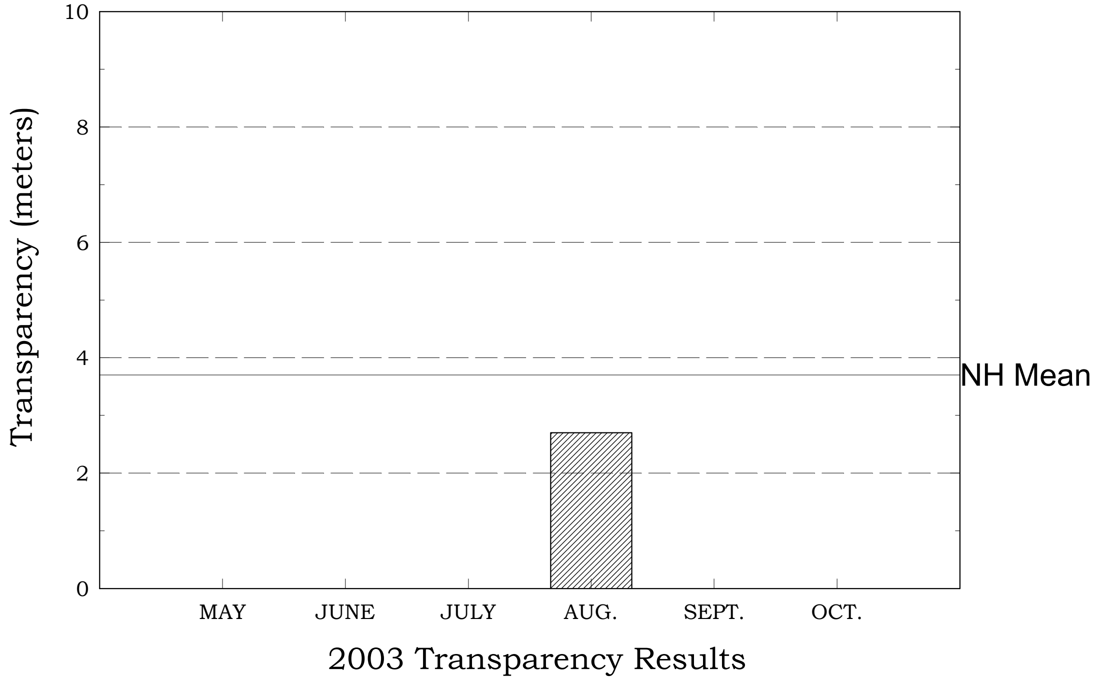
Figure 2. Monthly and Historical Transparency Results

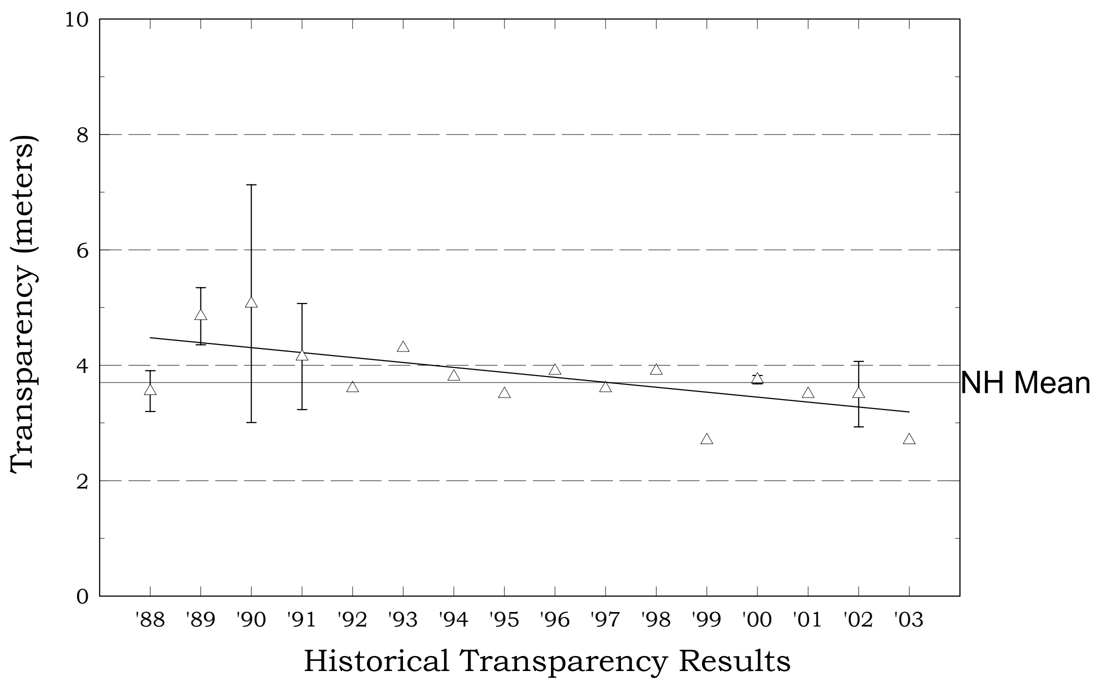




Cobbetts Pond, Stn 2, Windham

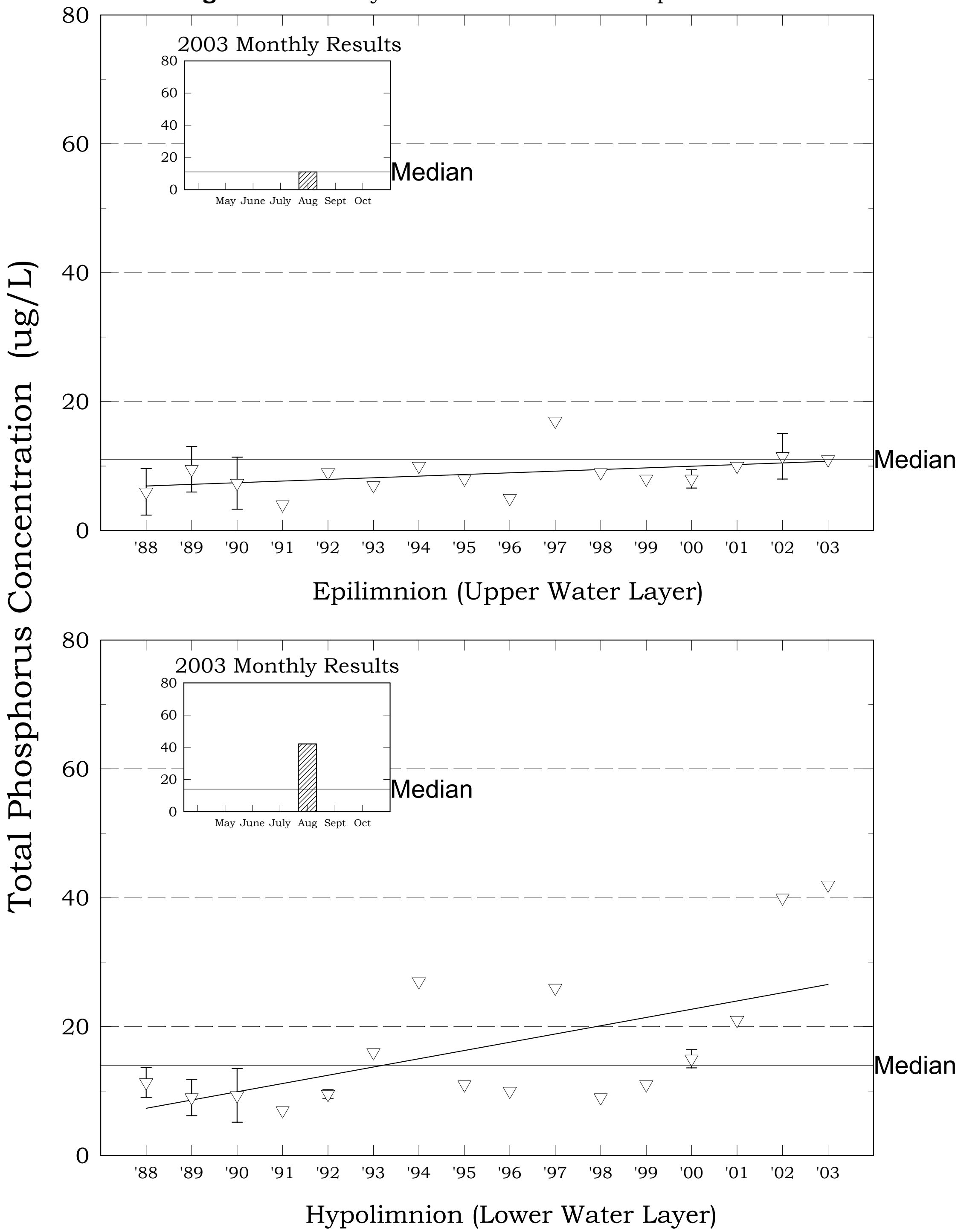
Figure 2. Monthly and Historical Transparency Results





Cobbetts Pond, Stn 1, Windham

Figure 3. Monthly and Historical Total Phosphorus Data.



Cobbetts Pond, Stn 2, Windham

Figure 3. Monthly and Historical Total Phosphorus Data.